

(copy)

THE STATE OF UTAH
Office of State Engineer
Salt Lake City

May 24, 1947

T. F. Wentz, Water Commissioner
Provo River System
Orem, Utah

Board of Canal Presidents
c/o W. D. Beers, City Engineer
City and County Building
Salt Lake City, Utah

U. S. Bureau of Reclamation
32 Exchange Place
Salt Lake City, Utah

David I. Gardner, Water Commissioner
Utah Lake & Jordan River System
R.F.D. #1,
Midvale, Utah

Provo River Water Users' Assoc.
c/o J. W. Gillman, President
Provo, Utah

Re: COMPROMISE ELEVATION - UTAH LAKE

Gentlemen:

For several years past there has been a question as to the correctness of the gauge on Utah Lake located at Jordan River pumps for indicating the compromise level. The question is whether or not this gauge has been set with its zero at compromise elevation as adopted by the court. During the year 1946, the State Engineer's office made a vertical control survey in Utah County for hydrographic purposes in the adjudication of water rights on Utah Lake and its tributaries. This survey was made according to standards adopted by the U. S. Coast & Geodetic Survey. First-order levels were run from Jordan Narrows along the main line of the Denver & Rio Grande Western Railroad from Jordan Narrows to Provo, thence southerly along the Los Angeles & Salt Lake Railroad from Provo to Santaquin.

The line of first-order bench marks established by the U. S. Coast & Geodetic Survey from Grand Junction to Salt Lake City, having elevations assigned according to the 1929 final adjustment, was followed along the D&RGW railroad as heretofore stated from Jordan Narrows to Provo. The line from Provo to Santaquin followed the line of bench marks set by the U. S. Coast & Geodetic Survey in its second-order leveling. All work done by the State Engineer was first order. Various closed loops were run first order off these two lines and the elevations in all instances were adjusted and made to conform to the 1929 adjustment of the U. S. Coast & Geodetic Survey, adopting the elevation 4548.610 for BM T17 of the USC&GS as being fixed and the elevation of 4494.135 for BM USGS H3 at Jordan Narrows. The elevation last given was assigned by the USC&GS in its 1929 adjustment.

During this first-order survey, one spur line and closed loops respectively were run first order so as to connect bench marks at Snail Island, Geneva Park, Jordan River Pumps and the bench marks set by Doremus between the years 1884 and 1899 along Jordan River from the Jordan River Pumps to a point on Jordan River near the narrows. This survey being made first order and the elevations being adjusted so as to give orthometric heights above

Re: Compromise Elevation - Utah Lake

mean sea level at the respective points, should be considered as of great value in determining accurately the adjusted mean sea level elevations of bench marks to be permanently used for establishing gauges referenced to compromise elevation on Utah Lake.

For record purposes, the surveys of the State Engineer herein referred to were made under the direction of F. W. Cottrell, Chief Deputy State Engineer, who made the adjustments and sea level determinations from notes of observations made in the field by R. J. Madsen, Field Engineer. Instruments used were tilting prism level of invar construction being No. 53 owned by the U. S. Coast & Geodetic Survey, having a bubble value of 1.7 sec. of arc per 2MM run and Wild Precise tilting dumpy level No. 3958 also of invar construction having a bubble value of 6.0 sec. per 2MM of run. Rods used were of precision type, graduated to yards, each with chilled tool steel foot. All rod readings were made by observing three wires and recorded to the nearest thousandth of a foot; all work being in accordance with USC&GS standard for first-order leveling.

Due to the fact that there is only one undisturbed bench mark originally set by order of the court to the Utah Lake Commission under the direction of Mr. Doremus, south of the pumps at the head of Jordan River, this bench mark being at Geneva Park a considerable distance north of the one set at Snail Island, which latter mark is the official controlling instrumentality so far as location is concerned, it behooves one to determine which of the two surveys formerly made is more dependable and adopt its reference to compromise.

During the period from October 21 to October 28, 1914, Messrs. T. F. Wentz and R. E. L. Collier made a level survey between Snail Island bench mark and the one at Jordan Narrows. During this survey, most of the Doremus bench marks were connected. Mr. Doremus acting as engineer for the Utah Lake Commission charged with maintaining compromise datum, during the period 1884 to 1899 set the bench marks to which reference is made hereinafter in connection with the Wentz-Collier survey. For the purpose of evaluating the results of the Wentz-Collier survey as compared with the Doremus survey and referred to the State Engineer's survey, the following is given:

Assuming a common elevation to start at the Geneva Park Monument set by Doremus, the elevation of the bench mark at Indian Ford set by Doremus at a distance of 19 miles is in discrepancy with the State Engineer's survey in the amount of +0.017 ft.; whereas, the Wentz-Collier survey at the same point and distance is in discrepancy with the State Engineer's survey in the amount of +0.273 ft. The bench mark stone set by Doremus at Big Bar at a distance of 17 miles, indicates that the Doremus Survey is in discrepancy with the State Engineer's survey in the amount of +0.171 ft.; whereas, the Wentz-Collier survey at the same bench mark is in discrepancy with the State Engineer's survey in the amount of +0.394 ft. This discrepancy on both surveys appears to be large for the reason that this bench mark was probably slightly

Re: Compromise Elevation - Utah Lake

disturbed, as indicated by comparing both surveys with relation to other bench marks.

The elevation of the Doremus stone set easterly from Jordan Bridge west of Lehi at a distance of 13 miles from Geneva, indicates that the Doremus survey is in discrepancy with the State Engineer's survey in the amount of -0.042 ft.; whereas, the Wentz-Collier survey at this point is in discrepancy with the State Engineer's survey in the amount of +0.236 ft. The Doremus Stone set near the Mercur Bridge crossing of Jordan River at a distance of 16 miles from Geneva, indicates that the discrepancy between the Doremus survey and that of the State Engineer is +0.013 ft. This stone was not connected by Wentz and Collier. The bench mark on Jordan River Bridge, west of Lehi, at a distance of 13 miles from Geneva, indicates that the Doremus survey is in discrepancy with that of the State Engineer in the amount of +0.046 ft. This elevation reference was not connected with the Wentz-Collier survey.

The dates of establishing bench marks set by Doremus and others with the respective elevations and descriptions of each are contained in a copy of Mr. Beers' letter of May 12, 1947, attached hereto. The low discrepancy mentioned herein between the State Engineer's survey and that of Doremus, with the exception of the bench mark at Big Bar which probably has been disturbed, indicates that the Geneva Park bench mark has not been disturbed. However, it is a well-known fact, as disclosed by the notes of the Wentz-Collier survey, that the bench mark at Snail Island and the one at Jordan River pumps have settled materially since they were established and, therefore, the one at the pumps is useless so far as disclosing the elevation at which it was originally set. The one at Snail Island is now destroyed; the one at the pumps is still in use and a new elevation has been determined for it as will be referred to hereinafter.

There is a discrepancy between the difference of elevation recorded by Doremus and that recorded by Wentz and Collier with reference to bench marks at Smith Lake and Geneva Park. In light of the foregoing, the elevation of compromise considering orthometric correction at the Snail Island bench mark has been determined from the elevation of the Foremus Monument, or Stone, at Geneva Park. Due to the fact that the Snail Island Stone was considered by the court to be the location for determining compromise, and due to the fact that this bench mark has now been destroyed, it becomes necessary to determine the orthometric correction to be applied to ordinary levels to make them fit a natural water surface at the elevation above sea level of Utah Lake for the distance in latitude from Snail Island north to Geneva Park. In determining the orthometric elevation above sea level of compromise level at Geneva Park referred to the Doremus survey and stone there, this has been taken into account.

For the reason that a lake water surface at considerable elevation above sea level is not a constant height above sea level in its north-south

Re: Compromise Elevation - Utah Lake

direction, it becomes necessary to determine the height above sea level of Utah Lake compromise level at the respective latitudes at which gauges will be necessary, based upon the compromise level at Snail Island at latitude 40°12' adopted by the court. After these elevations have been determined, compromise level used on any gauge at the respective latitudes may be recovered by connecting the gauge with levels run from bench marks in the same latitude, the orthometric elevations of which are known. The orthometric elevations above sea level are worked out in the following tabulation for five latitudes, viz., 40°09' at Lincoln Point; 40°12' at Snail Island; 40°20' at Geneva Park; 40°22' at Jordan River pumps, and 40°26' at Jordan Narrows.

To set a gauge on Utah Lake so its compromise graduation will coincide with compromise level at the Jordan River pumps, it should be set at elevation 4489.398, taken from the respective orthometric elevations on the bench marks described in lines 4 to 9 inclusive of the following tabulation. Likewise, to set a gauge similarly at Snail Island, the compromise graduation should be set at elevation 4489.466, as determined from the elevation of BCP No. 2 BM Underground Monument given in line 1 of the attached tabulation. Similarly, the compromise graduation of a gauge set at Geneva Park should be at elevation 4489.4115, taken from orthometric elevations of bench marks in latitude 40°20' given in lines 11 and 12 of the tabulation given hereinafter.

Descriptions and elevations of the bench marks referred to hereinbefore may be taken from the files of the State Engineer with respect to the survey made by him in 1946.

It is recommended that no attempt be made henceforth in establishing bench marks or any reference to compromise at Snail Island. This is for the reason that the ground at this location, being unstable, is not suitable for maintaining bench marks.

It is also recommended that gauges be established on Utah Lake, the zeros of which are at compromise elevation, at two locations, one at Geneva Park and the other at Jordan River pumps. At present, there are two underground marks near Geneva Park and one underground mark at the Jordan River pumps, with the second such mark near Saratoga. It is also recommended that at least one more permanent underground mark be established at Geneva Park and two additional underground marks near the Jordan River pumps. The marks at Geneva Park are in the same latitude. The bench marks at the Jordan River pumps should also be established at a common latitude with the gauge thereat.

Re: Compromise Elevation - Utah Lake

Name of BM	Latitude of BM	Orthometric Elev. of BM (Ft. above Sea Level)	Orthometric Elev. of Compromise at BM (Ft. Above Sea Level)	Ortho. Corr. to Apply be- tween BMs
0. Lincoln Point	40°09'	JR41 = 4526.341	4489.4862	
1. Snail Island (Same location as BCP No. 2)	40°12'	BM Destroyed	4489.4660	-0.0202 ft.
2. Geneva Park	40°20'	4504.004	4489.4115	-0.0545 ft.
				-0.0135 ft.

3. Various BMs at Jordan River Pumps	40°22'	*	4489.3980	
* See elevations of six bench marks established near the pumping plant as listed below.				
*4. USGS Gauging Station	40°22'	4492.401		
*5. USC&GS K41	40°22'	4494.170		
*6. West Doremus Stone	40°22'	4493.261		
*7. Copper Bead on Doremus Mon.	40°22'	4494.769		
*8. East Doremus Stone (buried)	40°22'	4491.987		
*9. BCP Underground Monument No. 5	40°22'	4491.774		-0.0268 **

10. BCP No. 2	40°12'	4486.780		
11. BCP No. 3	40°20'	4501.566		
12. BCP No. 4	40°20'	4501.988		
13. BCP No. 6	40°21'	4499.757		
14. H3 (Jordan Narrows)	40°26'	4494.135	4489.3712	

** Difference between Jordan River pumps and BM H3 at Jordan Narrows to apply only when stretch of river from pumps to narrows has no flow in it, i.e., only when it acts as arm of Utah Lake.

Re: Compromise Elevation - Utah Lake

During the month of April, 1947, levels were run from USC&GS BM K41, the West Doremus Stone and the Doremus Lake Monument to the Lake Gauge at the pump house. This survey indicated that in order for the gauge to be set properly in accordance with the compromise elevation as hereinbefore mentioned, the zero of the gauge should be raised 0.21 ft.

Mr. David I. Gardner has made the verbal statement that on approximately February 15, 1946, he raised this gauge 0.32 ft.

These figures are given in order that the past record of gauge heights on Utah Lake may be corrected so as to apply to the area-capacity table of the lake which it is assumed was surveyed on compromise datum and the areas and capacity determined for elevations referring thereto.

Yours very truly,

Ed. H. Watson
STATE ENGINEER

FWC/nty

Enc: Copy of Letter.